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## The error as a problem or as teaching strategy

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### Abstract

In this article we show how teaching by simulation, in our Center for Medical Simulation, has given us the opportunity to see errors as a valuable educational tool. We use a descriptive method to demonstrate how errors may sometimes be useful in achieving educational goals, and how this may not always be the case. In this paper we distinguish between the types of errors and the moments at which they occur, as well as the importance of assessing how competent the students are, and how difficult the activity is. This analysis will allow us to see that teaching through simulation enables us to act continuously on errors in a controlled manner and according to our training criteria. Successful teaching requires knowledge of the most common mistakes in procedures or interventions, which must be displayed at the right time. Taking into account human beings' capacity to make mistakes with relative ease, we must find ways to protect the safety of the patient, as well as to allow learners to acquire the skills needed to prevent these mistakes occurring later in real life. This means that teachers have to reflect and self-assess their performance and accept being evaluated by their colleagues and students, an attitude which is very valuable in the training of their students. We conclude by highlighting some indicators that may be appropriate in education to ensure that mistakes do not get through to the patient.

**Keywords:** Medical Education-Simulation Learning, Didactic Error, Self-Evaluation.

### Introduction

Almost 100000 people die per year, only in the US, as a result of medical errors (Kohn 1999, pp. 26-48). It seems reasonable to consider that the error should occupy a significant position in the process of academic training. This is feasible if a training target is set for students to acquire some skills that enable them to develop the following skills: habits of using appropriate communication; the ability to integrate theoretical and practical knowledge; the ability to acquire the technical skills required in each procedure; the ability to acquire verbal and other skills to explain their clinical reasoning; the capacity to exercise emotional control in adverse situations; the ability to understand and practice ethical and deontological standards and of course, the ability to reflect on everyday practice (Hundert et al., 1996, pp.624-642). There are many pages written on medical errors, but in virtually all the articles and many books, the focus is limited to its impact in the professional field, and few offer references about the importance which it should have in University medical education. An exceptional contribution is undoubtedly the conclusion of the study "Crossing the Quality Chasm: a New Health System for the 21st Century" (Institute of Medicine, 2001a, pp.45-73), which provides in its final report a proposal for integrating what have been defined as the five core competencies:

- Patient-centered care.
- Interdisciplinary teamwork.
- Evidence-based practice.
- Improvement of the quality of care.

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### -Use of instruments.

How can we put these objectives into practice? How can we develop competencies and evaluate them? From the instructor's point of view, teaching by simulation offers some features that make it very valuable in medical training. In the activities of the Center for Medical Simulation we have found that errors can be a tool of great educational value (Issemberg SB., 2005, pp.10-28 and Janis a., 2010, pp.583-603). To achieve relevant objectives it is necessary to detect and differentiate clearly the mistakes the students make and the points at which they occur. The teacher must know what previous knowledge the students have and should perhaps evaluate their level of competence before starting. In teaching through simulation, we can say that error is on our side, because it allows us to act continuously in a controlled manner and according to our discretion or training objective. A person is considered expert if he or she is able to solve problems in a particular area and detect what can go wrong, thanks to his/her experience or that of others (Turabián Fernandez JL., 2006, pp.165-67). To teach successfully, we need to know the most common errors in each procedure or intervention and display them at the right time. Taking into account the human capacity to make mistakes with relative ease, we are forced to develop ways to protect the safety of the patient. To this end, trainers must reflect and evaluate their teaching performance, and accept being evaluated by their colleagues and even by their students, in order to teach this attitude as something that is very valuable in their vocational training.

When we say that someone knows how to do something, we are assuming that the person understands and distinguishes when one should or should not do it. In other words, we value the ethical status of what is done, not just the technique. We need good examples of models to learn the ethical foundations of practice. Allegro points this out (Allegro I., 2001, p.2) when noting that:

"Ethics is taught by example and learnt using a model." "Example and model are two versions of the same reality: differ according to the point of view: if it is that of the teacher, or that of the learner"...

This condition is fulfilled in all human activity, which somehow assures us that we can always know more and therefore innovate. The consideration of ethics from a personal and social perspective is also very revealing (Polaino a., 1994, p364):

"Both the individual and society are committed to personal and collective health." The individual is responsible for his/her health through his/her habits of behavior, lifestyle, etc.; "society is responsible through legal, economic, health care, preventive measures, etc., designed to provide specific coverage for healthy and sick, individual and collective behavior."

### What is meant by mistake?

In the dictionary of the Spanish Royal Academy of the language, the entry for "error" gives us the following meanings:

- ☐ Mistake or false judgment, misguided or mistaken action, thing done wrongly.
- ☐ (Right) Factor which vitiates consent, caused by mistake in good faith, which annuls the legal act if it affects its essence or its object.
- ☐ (Physics and mathematics) Difference between the measured or calculated value and the real value.

We could also differentiate in an ethical sense between excusable error and negligent or guilty error, but our object of study is rather to highlight the features that the teaching method must take into account, given the condition of the human being, that will allow the student to continuously learn new abilities, skills and competences, but always, in greater or lesser degree, with an inevitable error factor (Popper k., 1988, p.156):

"It is impossible to avoid all error or even just all avoidable error. Errors are continually being made by all scientists. The old idea that errors can be avoided, and so that we are obliged to avoid them, should be reviewed: it is wrong. "

Wrong actions must be analyzed and studied trying to define and differentiate the moment at which the error occurs in order to plan its appearance in the teaching process and contextualize it. To this end, the reflexive approach suggested in the context of medical errors may be useful, in which various aspects can be analyzed (Agrest A.) (, 2006, p.3):

- 1) Detection of errors.      (2) The communication or medical confession of error.
- (3) Registering errors.      (4) Analysis of the causes of these errors.
- (5) Who is responsible for these errors?
- (6) The medical response to the error and the consequences.

### Learn to teach better

Our learning is situated and dependent, as are all our powers and capacities (Clancy w., 1995, pp.49-70). This plasticity is precisely what configures us as beings that can learn, not just ones that need to learn. The human capacity to learn is so radical that it facilitates the possibility of not merely settling for adaptation to the environment, rather it allows us to adapt the environment to our interests (Von Wright, g., 1994, p.109) The period of human training and learning is a long period which begins at birth and develops throughout life, in different fields and levels, not finishing until death, a phenomenon known as "lifelong learning" (Guillén, Fontrodona and Rodriguez, 2007). There is a similar dynamism at all stages of learning in which in a similar way, along our life's path and in multiple dimensions, we move forward with the uncertain dynamics of trial and error because you learn by moving from the known into the unknown and with a relative personal mastery of the conditions of learning. Therefore, a key in the teaching relationship with the students will be offering trust (Christopher D., 2006, p.31), in view of the dithering and uncertainty of the learner when he/she faces different types of learning, with the various internal and external constraints that affect his/her attempts to move forward. As a theoretical basis, a clear classification of types of learning outcomes and the constraints affecting acquisition sheds considerable light. (Gagné r., 1979<sup>a</sup>, pp.23-45)

Table1. Types and conditions of learning outcomes according to Gagné.

Types of learning	Acquired ability	Internal constraints	External constraints
<b>Symbolic or linguistic</b>	Intellectual	Learn to read, write, and use numbers.	Education and interaction.
<b>Of expression or relational</b>	Communication	Verbal information and second skills	Context and normal relations.
<b>Rotate or retention</b>	Cognitive strategies	Synthesis and analytical capacity.	Learning techniques for reasoning and retention strategies.
<b>Psychomotor or technical</b>	Psychomotor	Psychomotor skills and provisions to exercise of or interest in technical skills	Context physical and technical education.
<b>Attitudes and behavior</b>	Emotional attitudinal	and Beliefs, ideas, preferences and emotions.	Models and ethics-moral training

"Learning is a change in human capacities or dispositions, which persists for some time and is not attributable only to the processes of development" (Gagné r., 1979b p.2)

We learn according to our interests and personal needs, but learning is situated, as we said previously, and throughout the various life stages we are better or worse trained and more or less willing to learn. At the stage of

university education the willingness to learn should be promoted and encouraged because of the major requirements of the curriculum; many dispositions and capacities can be developed thanks to the interest and motivation aroused in the model of teaching by simulation.

### **Error in teaching by simulation**

It is necessary to analyze the causes that give rise to the error and its consequences, on both a personal and a social level. The error in medical practice can have an impact on patient safety and quality of care. Although it seems ironic, I believe that it is correct that (Martinez Aldanondo j., 2004, p.28):

"An expert is a person who has made any mistakes that it is possible to make in a very specific field."

This is where the teacher tries to teach how to perform a certain maneuver or technical procedure, sequencing and offering at each moment the demonstration to facilitate the integration of success with error, so that the apprentice learns the error at the time as this happens, because if we present it only theoretically or in a decontextualized way, his/her learning will be more laborious and it will be more difficult for him/her to consolidate and integrate his/her knowledge. It might even generate doubt and confusion in their learning. (Institute of Medicine, 2001b, p.129) Another important factor to promote this integration is our understanding of students' previous knowledge before we start to demonstrate the implementation or practical exercise. Gaps or deficits in the previous knowledge that is required in the activity may cause inconsistent or incoherent learning which in many cases will call for further teaching. No doubt it is of great importance that teachers know where their students are starting from, since this is the foundation on which learning may take place. (Ausubel, 1976, p.2) writes in the introduction to his book *Educational Psychology*:

"If I had to reduce educational psychology to a single principle, it would be this: the most important factor influencing learning is what the student already knows. Find this out, and teach accordingly".

The teacher needs to reflect on his/her educational style, on the adequacy of what he/she aims to teach, and the sequencing of how to present the exercises; the examples that can help to contextualize the learning; the questions that he/she will ask to find out if the level of planned learning and understanding of the educational objectives is being achieved; resources for maintaining attention as long as possible; the way of offering the content to make it attractive and motivating for students, so that they get involved and want to continue learning. In this previous planning and reflection, the teacher will have to assess the degree of difficulty of the content, foresee and define the most common mistakes, as well as the moments at which they occur, because it may be valuable to provoke errors to facilitate self-correction. It can be of great educational value for teachers to try to remember their own learning process and how they learnt to identify or distinguish mistakes in their own practices. (Epstein RM and Hundert e., 2002, pp.226-35)

### **The keys to self-correction**

Error becomes a very interesting learning tool when it is the student his/herself who discovers the mistake.

"An error (corrected by the subject) may be more fruitful than immediate success, because the understanding of a false hypothesis and its consequences provides new knowledge and comparison between two mistakes gives new ideas" Piaget, J. (1978)

The teacher must ensure that the student has moments of reflection while he/she is doing the task, so that he/she can become aware of errors without direct intervention by the teacher. and also learn from corrections given to his/her fellow students. Videoing of the activity allows the student to recognize his/her own mistakes, with all the benefits of self-correction. On the other hand, seeing the recording helps the class to recall the key points and objectives of the activity, highlighting the successes of individuals or the group that the teacher has been able to observe, so that both the student and the group positively value their participation in the activity and subsequent evaluation, and there is group discussion during the viewing of the video (Neill, M. a., and Wotton, k., 2011<sup>a</sup>,

pp.161-8). During the learning stage, the teacher should avoid an intrusive attitude to errors because it can generate distrust in the pupils and hinder them from participating and engaging in learning. On the other hand, if there has not been intense preparation of the activity, it is easy to feel tempted to correct all the errors committed during the activity, producing some distortion in the real key objectives of the activity and causing confusion in teacher's judgment. Corrections have a different value or rank according to the likelihood of their appearance. Simulation as a learning methodology allows us to "play" with the error. It has the potential to encourage learning by allowing mistakes to be made but ensuring that participants immediately see the consequences of each action, or letting them continue with activity until they detect the error and its consequences. (Torre s., 2004, pp.24-34) Error accompanies knowledge because the latter is always incomplete or at least limited to the conditions of the time and place. This may be better understood if we use the comparison that error is to knowledge what shadow is to light. Controlled error is highly motivating in the learning process because the possibility of undoing a wrong action, without leaving sequelae, helps the learner to participate without fear, reinforce knowledge and predict errors that have already been experienced in each performance. It is also very motivating for students when the teacher can assist them individually. Here, it is very important that in learning scenarios and practical classes in the Centre for Medical Simulation, the teacher ratio student should not be more than six-eight people, because the student in his/her trial – error process, requires the approval or correction of a more experienced person to move forward with security.(Dieckmann p., 2009, pp.219-25) We have seen that students value learning in a peer group, since this allows them to solve problems, thanks to the closeness and trust within the group, which enables them to ask questions that perhaps they would not ask a teacher. A magnificent bibliographical review on debriefing after practical classes may be consulted (Neill, M. a., & Wotton, K a. 2011, 161-8), which is of great interest in analyzing all the varying didactic techniques that can make this reflection more valuable in group activity. The objectives of the debriefing are to analyze the mistakes, discovering the way in which they occur, and tracking the consequences, as well as analyzing the causes and their prevention. The aim is also to achieve intragroup communication in which a constructive critical spirit helps students to give reasons and provide opinions and evaluations that can enrich the final outcome. In the debriefing, the instructor will seek to guide and promote participation, ensuring that everyone contributes, by strengthening and supporting those interventions that add to the discussion and redirecting those that lead to arguments or misunderstandings. Only if any relevant issue fails to appear during the debriefing should the instructor draw attention to it and clarify why it needs to be mentioned in the group discussion.

## Conclusions

To err is a condition of humanity, and ethical considerations oblige us to avoid the consequences of errors, which is possible if we establish indicators and formulae that can detect such mistakes. Our personal attitude towards own errors and those of others is of great importance in the professional world and no less in the personal or relational field. It is not easy to prepare the student in all personal ethical and professional competencies, but simulation allows us to take advantage of the error to improve and consolidate student learning, promoting an attitude of character and personal interest in the improvement of care and patient safety. It also allows us to teach the student to accept criticism in team work and assess the relevance of being able to think about his/her own activity to promote self-correction. In the learning stages that we work on with the students of medicine at the Centre for Medical Simulation, the different roles that are assigned help us to understand the importance of knowing and controlling for mistakes, and of communicating them and having the agility to react and avoid the effects on the patient. We suggest some ways specific to teach students how to control for the effects of mistakes in medical action, such as:

- ☐ Preparation of a Check-list for each task or procedure with which to evaluate and assess the performance of each participant.
- ☐ Preparing each case and promoting participation in the debriefing following learning scenarios.
- ☐ Identification of the patient so that all participants always asks his/her name and surname, age, etc. when they intervene in the case.



- Attaching a patient identification label, which should include the process or procedure he/she is to undergo.
- Assigning one participant the role of "Check-list controller" and "defender" of the patient during the exploration and other procedures.
- Promoting teamwork in order for students to discover and accept their own limitations, further their desire to overcome their limits and be inspired to improve and help others to do so.

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